

**Tubular Structures on the Cuticle of Two *Gordius* Species
(Nematomorpha, Gordioidea, Gordiidae) from Korea and
New Zealand**

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ABSTRACT

We describe tubular structures on the cuticle of two representatives of the genus *Gordius* by scanning electron microscopy. One female from Korea could not be identified further while a male from New Zealand belonged to *Gordius paranensis*. Other male specimens of *G. paranensis* did not show tubular structures or the corresponding pores on the cuticle. Therefore it is assumed that tubular structures are not species-specific structures, but are also no artifacts or contaminations. They might be glandular products, but this has to be verified by further documentations and investigations of the inner structure of it.

Key words: Nematomorpha, *Gordius*, tubular structures, SEM

INTRODUCTION

The Nematomorpha or horsehair worms are known with about 300 species from freshwater and with four species from marine environments. They parasitize insects most abundantly (see Schmidt-Rhaesa, 1997 and 2001), but reproduction and early larval development take place in the free environment. For identification, cuticular characters are the dominant source of information. The cuticle is often covered by areoles which are elevated structures separated by interareolar grooves.

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Additionally, cuticular structures on the posterior end, especially from males, are important taxonomical characters. Most species of the genus *Gordius* are devoid of or very poor in cuticular structures and also often lack structures in the male posterior end, except for the so-called postcloacal crescent, which is characteristic for the genera *Gordius* and *Acutogordius* (Schmidt-Rhaesa, 1997; Heinze, 1952). The scanning electron microscopy has become a standard technique for the investigation, description and documentation of cuticular structures in Nematomorpha. Here we report a previously unknown structure on the cuticle of two *Gordius*-species from Korea and New Zealand.

MATERIALS AND METHODS

The specimen from Korea was collected by P.-R. Chung and colleagues in a freshwater system of Dongsu Chon (37° 38'N-128° 29'E) connected with South Han River, Pyongchang county, Kangwon province, South Korea. The specimen from New Zealand was collected in Cass railway reservoir, Central Canterbury, South Island (43° 02'S and 171° 45'E).

For scanning electron microscopy, specimens were fixed in 70% ethanol, dehydrated in an increasing ethanol series, critically point dried, sputtered with gold and observed with a Hitachi S-450 SEM under 15 kV.

RESULTS

The Korean specimen is a female. The lack of any cuticular substructure made it very likely that it belongs to the genus *Gordius*, because all the other genera have cuticular structures on their surfaces. In comparison to the New Zealand specimen, the cuticle of the Korean specimen appears not completely smooth under high magnifications, but with a rough surface due to fibrillar structures (Fig. 1B) which might represent collagen fibrils. Due to the lack of further taxonomically important structures, the species could not be determined further. Previously described Korean *Gordius*-species are: *G. lineatus*, *G. pallidus*, *G. robustus* and *G. semilunaris* and they were described on the basis of males (Linstow, 1906; Camerano, 1915; Baek and Noh, 1992). Three males of the New Zealand specimens were investigated by SEM. All three males were determined as *Gordius paranensis* due to a peculiar semicircular row of bristles in front of the cloacal opening (Fig. 1A) (Schmidt-Rhaesa *et al.*, 2000), but only one carried the tubular structures described below.

The cuticle of both specimens contained irregularly scattered hollow tubular structures (Fig. 1B-E) of varying lengths (maximally 12 µm). The surface of the tubules may be folded and the opening, therefore may exhibit various shapes (Fig. 1B, C). The tubules stick out of pores in the cuticle and seem to originate below the cuticle (Fig. 1B, C, E). Therefore, they belong to the animals and are not superficial contaminations.

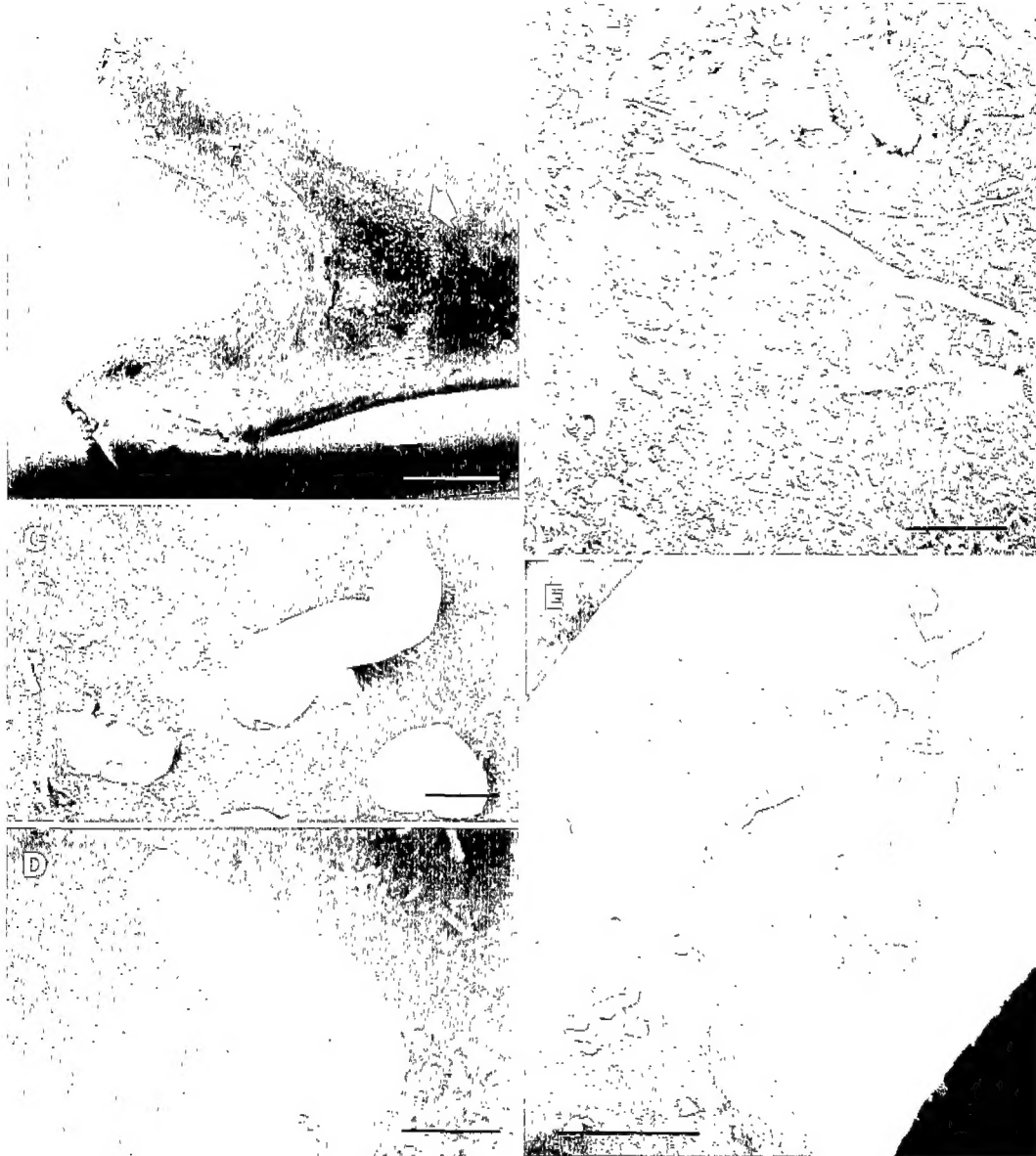


Fig. 1. Tubular structures on the cuticle of two *Gordius* species. A, posterior end of a male *Gordius paranensis* (New Zealand specimen) with characteristic semicircular row of bristles in front of the cloacal opening (arrow); B, Korean specimen with rough cuticle and tubular structures; C, D, folded tubular structures on the cuticle of *G. paranensis* from New Zealand; E, overview on tubular structures on the cuticle of *G. paranensis*, close to the posterior end. Scale bars = 100 μ m (A), 10 μ m (B), 5 μ m (C, D), 50 μ m (E).

DISCUSSION

Tubular structures described above have never been reported from nematomorphs before. The

fact that they were found only in one of three specimens of *Gordius paranensis* and that they have not noted in previous investigations of this species (Schmidt-Rhaesa *et al.*, 2000) makes it likely that this is not a species-specific character. However, the occurrence on specimens from two widely separated localities such as Korea and New Zealand makes it unlikely that this character is an artifact or a contamination. *G. paranensis* has only been reported from New Zealand and South America (Schmidt-Rhaesa *et al.*, 2000) and it therefore is unlikely that the Korean female, although not further identified, belongs to the same species.

The function of the tubular structures remains unclear. They might be glandular products of subcuticular glands. Currently the epidermal structure in nematomorphs has been documented only from very few species and large glands are unknown. It will be interesting to make a further document on the occurrence of tubular structures and to reveal their inner structure.

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요 약

저자들은 한국과 뉴질랜드에서 채집된 철선충(*Gordius* 속)의 표피상에 나타난 관상구조를 주사전자현미경으로 관찰하였다. 한국산 철선충의 암컷 한 마리는 종을 동정할 수 없었으나 뉴질랜드산 철선충의 수컷 한 마리는 *Gordius paranensis*로 동정되었다. 다른 뉴질랜드산 *G. paranensis* 수컷들에서는 표피상의 관상구조나 관상구조 저변의 소공들을 갖고 있지 않았다. 이로서 표피 관상구조는 종 특이성을 나타내는 구조물로는 속단하기 어려우나 그렇다고 이들은 조작과정 중의 오염물도 아니다. 이 관상구조물들은 충체의 샘조직의 산물로 여겨지며 앞으로 이들의 내부구조등에 관한 연구가 있어야 할 것이다. 철선충 표피상의 관상구조물은 처음 보고되는 것이다.